2.—SOME WESTERN AUSTRALIAN UPPER PALAEOZOIC FOSSILS.

By K. L. PRENDERGAST, B.Sc. (Hons.).

Read 14th August, 1934; Published 31st May, 1935.

CONTENTS.

INTRODUCTION.

The correlation of beds in geographically distant localities must be based, in the main, on published lists of fossils. In some cases these lists have been copied from paper to paper without examination of the specimens, with consequent faulty correlation. An examination of some Western Australian fossils with partial revision of lists was commenced by Miss L. F. V. Hosking in 1931. All the shells described in this paper have been previously listed, but owing to recent changes in palaeontological nomenclature now require renaming.

The history of the palaeontology of the Permo-Carboniferous of Western Australia is divisable into three schools governed respectively by the English, the Eastern Australian, and the Western Australian workers in the subject.

Of the earliest, the English, apparently the first published descriptions were those of Hudleston in 1883. The paper was confined to a collection made by the late Sir John Forrest. Among the specimens listed are Echinoderms, Brachiopods, and Lamellibranchs, but the only descriptions are of Corals and Polyzoans.

Mr. E. T. Hardman, of the Geological Survey of Ireland, was the pioneer geologist of the Kimberley, and his researches laid the foundation of our knowledge of the geology of that district. In the course of his investigations Hardman made an extensive collection. A part of this collection

was presented to the British Museum in 1886, and additional specimens were forwarded after Hardman's death. Dr. Henry Woodward edited a series of papers on the description of the specimens contributed by A. H. Foord (Brachiopoda, Mollusca, Pteropoda, and Crustacea), R. Kidston (Plants), H. A. Nicholson (Stromatoporoids), and G. J. Hinde (Corals). Foord's descriptions included notes made on the collection by R. E. Etheridge. Hardman's field determinations, as contained in his report, are, therefore, replaced by the series of papers listed above.

In 1886 Dr. Henry Woodward published a description of a fish (*Edestus davisii*) from the Gascoyne River. The exact generic position of this species has been a matter of controversy for some years, the age of the containing rock being dependent upon the genus. As the specimen was found in a boulder, and no further specimens have been found, it seems that the importance of the specimen has been over-rated.

From 1886 onwards the major portion of the Palaeozoic Palaeontology of Western Australia was done by Australian geologists. The greatest worker in this field was R. Etheridge, junior, of the Australian Museum, Sydney, whose work must form the basis for future work. In 1889 appeared an article in the Proceedings of the Linnean Society of New South Wales, being a description of some Western Australian fossils in the Macleay Museum, Sydney. The report of the Department of Mines of New South Wales for 1889 contained a short note on some fossils from the Irwin River. The work as official palaeontologist to the Geological Survey of Western Australia began in 1903 (Bull. 10). This Bulletin contains descriptions of Carboniferous fossils from the Gascoyne District, and was the first recognition of the importance of palaeontology in the unravelling of the stratigraphy of the Carboniferous rocks. Etheridge's second contribution was a description of plant and animal remains from the Irwin River, published as a Bulletin of the Geological Survey (No. 27 of 1910). This was followed in 1914 by Bulletin 58 on more Carboniferous fossils from Mount Marmion and other localities in the North-West Division of the State. The last work of this writer on Western Australian Palaeontology is a description of the fossils collected by the Basedow Expedition in 1916.

F. Chapman, now Commonwealth Palaeontologist, has contributed many papers on this subject. In Bulletin 27, G.S.W.A., the Carboniferous fossils in the collection of the National Museum, Melbourne, which has been sent from the Collie District, are described. Since his appointment as Commonwealth Palaeontologist, Chapman has published several lists of Western Australian fossils.

The third Eastern geologist was Rex. W. Bretnall, who in 1926 compiled a complete description of Western Australian Polyzoa with the aid of some of Etheridge's notes. This was published in Bulletin 88, G.S.W.A.

A very useful work on Western Australian Palaeontology is contained in Bulletin 36 of the Geological Survey of Western Australia, with a supplement in Bulletin 88. This is a list of Western Australian fossils systematically arranged by L. Glauert, giving a complete bibliography of the subject to the date 1925. Prior to this, in 1912, Glauert completed a description of a new Brachiopod from the Byro Plains, together with a list of fossils from that locality.

Since 1926 no further contributions have been published by the Geological Survey, the Royal Society of Western Australia now publishing the

majority of papers on this subject. The latest contributions are those of Miss L. Hosking. Two of her papers—The Specific Naming of Aulosteges from Western Australia and Western Australian Orthotetinae—deal with individual problems, while the later ones give full descriptions of new species with records and further figures of those previously described.

The inaccessibility of the fossiliferous horizons explains the relatively small amount of work that has been done. These localities are separated by enormous distances in almost uninhabited country. Zoning, under such circumstances, is an impossibility, so that advances of Western Australia Palaeontology must depend for some time upon the recording and description of specimens.

The author is indebted to Miss L. F. V. Hosking (now Mrs. N. Hanrahan) for advice and assistance in the preparation of this paper; to Mr. H. J. Smith for the photographic work; the Mining Museum, Sydney, and the Australian Museum for the loan of specimens; and Mr. T. Blatchford, the Government Geologist, for access to literature and the generous loan of specimens.

NOMENCLATURE.

In Palaeontological papers the same terms are used in a different sense by different authors. In order to avoid misinterpretation the terms used in this paper are defined below. The usage is in accordance with that of Thomson.[1]

DEFINITION OF TERMS.

Apical Plates: used as a substitute for crural plates. A neutral term not indicating a specific function, and therefore useful in cases where the function of the plates is unknown.

Biramous Spines: Spines arranged with a longitudinal partition, hence the spine has two circular or oval cavities.[2]

Chilidium: A plate similar to the deltidium developed in the brachial valve.

Crumples: Sub-concentric ribs without regular arrangement.

Crural Cavity: The cavity enclosed between the apical plates.

Crural Plates or Crura: Processes diverging from the cardinalia, and generally curved towards the ventral valve.

Curvature of the Umbo: Thomson[3] says "The curvature of the ventral beak towards the dorsal valve is usually expressed by such terms as 'suberect,' 'erect,' 'slightly incurved,' etc., the sense varying with the author . . . To ensure precision it is recommended that the terms should be used in the sense indicated in the accompanying diagram." (Fig. 33.)

Thomson's figures have been interpreted as follows:—

A Straight: the axis of the umbo is parallel to the plane of the commissures, in the opposite sense.

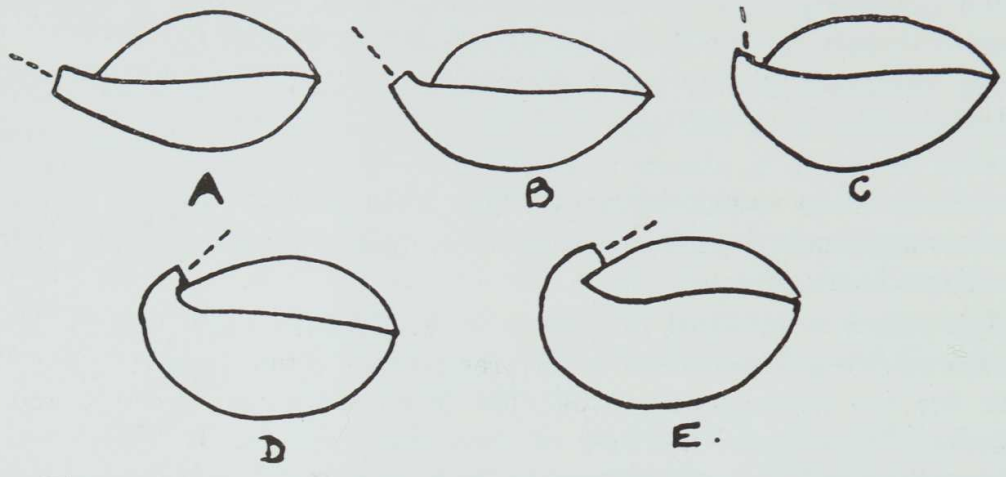
B. Suberect: the axis of the umbo lying between the straight and erect positions.

C. Erect: the axis of the umbo is perpendicular to the commissural plane.

1 1927. 2 George, 1932. 3 Thomson, 1927, p. 30.

D. Slightly-incurved: the inclination of the umbonal axis and the plane of the commissures is between 90° and 45°.

E. Strongly-incurved: the inclination is less than 45°.



Text Figure 1. Diagram showing the terminology of the curvature of the umbo.

Deltidium: an impunctate triangular plate present on the cardinal area of the pedicle valve, only in the Protremata.

Dental Lamellae or Dental Plates: plates supporting the teeth, usually free though sometimes joined to the bottom of the valve.

Hinge-plate: a horizontal plate separated anteriorly from the floor of the valve by a cavity.

Parasulcate: a shell in which the uniplica is present with a sulcus formed on each side of it.

Pectinated Ridges: growth lamellae continued forward as a fringe of closely set spines.

Plications: coarse radial markings.

Rectimarginate: a shell in which each valve is regularly convex, though not necessarily equal in convexity; the front margin is straight.

Sinus: the term sinus should be restricted to a ventrally directed curve in the course of the commissure.

Striae: fine radial markings.

Sulcus: decrease in convexity along lines running from the umbo to the margin.

Uniplica: a shell in which a single fold in the brachial valve is opposed to a sulcus in the pedicle valve.

All measurements are taken in millimetres, and where the sign + appears following a figure it indicates measurement along a broken shell.

The name of a species where included in inverted commas, indicates a wrong indentification.

Genus **Spanodonta**[1] n. gen.

Shells concave-convex dorso-ventrally. Shell substance impunctate and ornamented with fine plications which increase by bifurcation. The area of the pedicle valve is inclined and flat; it has a well-developed deltidium. In the brachial valve the area is very narrow.

[1] σπανις, scarcity, from the lack of denticulations along the hinge-line.

The crural plates of the brachial valve are united to the cardinal process, the whole forming a vertical sub-crescentric process. The crural plates diverge and curl forward to form a spoon-shaped cavity with the concavity facing backwards and outwards. The muscle marks are flabellate and separated by a median ridge. Visceral cavity defined by marginal elevations. In the pedicle valve the dental plates are short, not reaching to the bottom of the valve.

Geno-type: Spanodonta hoskingiae sp. nov.

These shells are closely allied to Stropheodonta, from which they may be distinguished by the impunctate character of the shell, the absence of denticulations along the hinge-line and the presence of marginal elevations.

The internal and external characters remind strongly of the Orthotetinae but in that group the shells are convexo-concave dorso-ventrally.

Spanodonta hoskingiae[1] n. sp.

Pl. III., fig. 1-3.

1923. "*Productus tenuistriatus* var. *foordi*" Eth. fil.

"*Productus* sp." in Chapman, List of Fossils from the West Kimberley; G.S.W.A. Ann. Prog. Rept. 1923, p. 35-36.

Shells small, the hinge-line less than the greatest width of the shell. The maximum width is at about the mid-length of the valve.

In the young stages the pedicle valve is slightly convex, the convexity increasing with age. The umbo is not prominent, being hardly elevated above the general level of the cardinal area. This is wide and is divided medially by a deltidium. The deltidium is broad, the angle of divergence of its sides in some cases as great as 90°.

The brachial valve is regularly concave and has a well-developed area and chilidium. The valve becomes thickened with age, so that the interior appears geniculate in the later stages. The smallness of the shells is shown by the table.

Length of the pedicle valve.	Width.	Length of the hinge-line.	Depth.
15.0	17.5	12.0	3.3
15.0	13.0	12.0	—
15.0	13.3	13.0	—
13.0	13.0	11.5	—

Syntypes Nos. 2530, 3052, 2750, University of W.A. Geol. Dept.

Localities: Price's Creek, Rough Range, 2½ miles NNE of bore at Price's Creek, Kimberley.

North-West portion of Price's Creek, Kimberley.

Genus LINOPRODUCTUS Chao.[2]

1927. Chao, Y. T., Productidae of China, Pt. 1, Pal Sinica. Peking. Ser. B, Vol. V., fasc. 2, p. 128.

---

1 The species is named after Miss L. F. V. Hosking.

2 Synonyms. Cora Fredericks 1928, and Cancrinella Fredericks 1928, vide Muir-Wood, H.M., 1930, p. 105.

Linoproductus cancriniformis (Tschernyschew).

Pl. II., fig. 7-12.

1889. *P. cancriniformis* Tschern. Mem. Com. Geol. Russia, St. Peterbourg, 111, No. 4, p. 373, Pl. VII., fig. 32 and 33.

1907. *"P. undatus"* Defrance, Eth. fil., Palaeontological Contributions to the Geology of Western Australia: Pt. 1, G.S.W.A. Bull. 27, p. 30.

1908. *P. cancriniformis* Tschern., Diener, Himalayan Fossils: Pal. Ind. Ser. XV., Vol. 1, Pt. 4, p. 31, Pl. 1, fig. 7-10.

1908. *P. cancriniformis* Tschern., Diener, op. cit.: Pt. 3, p. 25, Pl. IV., fig. 6 a-b, 7 a-d.

1918. *"P. bellus"* Eth. fil., in Basedow, H., Narrative of an Expedition in North-Western Australia: Trans. Roy. Geog. Soc. Aust. S.A. Branch, Vol. XVIII., p. 254, Pl. XXXIX., fig. 4 and 5, Pl. XL., fig. 6.

In 1907, Etheridge, recording *Productus undatus* from the Irwin River, pointed out that the specimens agreed with only one of Davidson's[2] figures (Pl. XXXIV., fig. 7).

Again, in 1908, Diener[3] questioned the identification of these shells. Writing of *P. undatus*, he said, "The Australian species differs from the typical shape of *P. undatus*, as it is described by deKoninck, by the larger number of spines, and reminds strongly of *Productus cancriniformis* . . . . . This variety of *P. undatus* can barely be distinguished from *P. cancriniformis*, if one has to deal with ventral valves only, the chief difference consisting in the shape of the dorsal valve, which is regularly concave in *P. undatus*, but distinctly geniculate in Tschernyschew's species."

The brachial valve of the Irwin shells are strongly geniculate, hence they must be referred to *P. cancriniformis* rather than to *P. undatus*. The fossils occur in a grey limestone near Fossil Cliff, and in the same limestone are numerous slightly convex impressions, which show the same ornamentation of concentric crumples, radial striae and spine bases, but without a geniculate margin. Their length is not so great as that at which the larger specimens become sharply bent over, hence they are probably impressions of brachial valves of younger individuals.

Describing fossils from Balmaningarra, Mt. Marmion, in 1918, Etheridge includes a new Productus—*P. bellus*. Etheridge's types of this species (Australian Museum, Sydney, Nos. F. 16731, 16734, 16735, 16736, 16742) include one flattened and three fairly convex pedicle valves and a geniculate brachial valve, which show no characters distinguishing them from *Linoproductus cancriniformis*. Etheridge, in his descriptions of *P. bellus*, says that it approximates in shape to *P. carbonarius* de Kon, but on comparing Davidson's descriptions and figures of *P. carbonarius*[4] with *P. undatus*, and with Diener's figures of *P. cancriniformis*, there appears to be no distinct difference in shape between the three. Again, Etheridge says that *P. bellus* is distinct from all other Productidae in having two rows of alternating spines on the cardinal margin. This is a character of *P. cancriniformis*.[5] On these grounds, therefore, *P. bellus* and *P. cancriniformis* cannot be separated.

2 Davidson, T., 1861, p. 161, Pl. XXXIV., figs. 7-13.

3 Diener, C., 1908, p. 24.

4 Davidson, 1861, p. 160, Pl. XXXIV., fig. 6.

5 Diener, op. cit. Pt. 4, p. 32, Pl. 1, fig. 8, 1908.

Among the collection are specimens in which the concentric crumples are strongly marked. On this account they have been placed in *P. cancriniformis* rather than in *P. cancrini*, Verneuil; although Diener thinks that *P. cancriniformis* is not distinct from *P. cancrini*.

It must be noted that some of the specimens differ in their proportions from those of the Productus shales, as the commonest forms of the latter are longer than broad. Diener says, however, that his specimens are very variable in shape, and some have been found broader than long. The majority of the Irwin shells, as with those from the Productus shales, are longer than broad.

Smaller specimens of this species have been collected at Oscar Range Station. From the smallness of the shells it is thought that the physical conditions must have been unfavourable to their growth.

Specimen Nos.:

2511, 10822, 10823, University of Western Australia, Geology Department.

A 371, A 379, Geological Department, University of Western Australia.

1/4970, Geological Survey of Western Australia.

F. 16731, 16734, 16735, 16736, 16742, Australian Museum, Sydney.

Localities:

Fossil Cliff, Irwin River District.
Balmaningarra, Mount Marmion.

Genus WAAGENOCONCHA Chao.[1]

1927. Chao, Y. T., The Productidae of China: Pt. 1, Pal. Sinica, Ser. B, Vol. V., fasc. 2, Pt. 1, p. 85.

Waagenoconcha imperfecta sp. nov.[2]

Pl. IV., fig. 1-3.

1923. *"Productus subquadratus"* Morris. Chapman, List of Fossils from the West Kimberley: G.S.W.A. Ann. Prog. Rept., p. 36.

In the adult the shell is longitudinally oval, the hinge-line being always less than the greatest width of the shell. The shell has its maximum width at a distance of two-thirds of the length from the umbo. There is no cardinal area.

The pedicle valve is moderately convex and is regularly curved longitudinally; transversely the sides slope steeply. The beak is strongly incurved and overhangs the hinge-line. The valve is divided into parts by a sinus which extends from the umbo to the anterior margin; as it approaches the margin the sinus flattens out and in the largest specimens the margin is entire. The umbonal cavity is smooth but a pair of large longitudinally striated, flabellate muscle scars arise about a fourth of the length from the umbo and extend to a point half the length from the umbo.

---

1 Synonym, Ruthenia Fredericks 1928, fide Muir-Wood, H.M., 1930, p. 104.

2 The species is called "imperfecta" since it agrees imperfectly with the generic description.

The brachial valve is almost flat, but a median fold, arising in the centre of the valve and widening towards the margin, gives to the anterior portion a concave appearance. A median septum is present in the brachial valve and is joined to a triangular hinge-plate, which is continued posteriorly as a strong cardinal process. Where the shells are weathered, the median septum, hinge-plate and the cardinal process stand out as a cruciform projection. The median septum continues forward to within a fifth of the length from the margin.

The ornamentation is not preserved on the majority of the specimens. Where preserved the whole surface of the shell is covered by fine tubercles, regularly arranged in quincunx. Each tubercle gives rise to a spine. The spines are small, inclined obliquely forward and distributed over both valves.

As the figures given in the table indicate, the shell outline changes with growth. In the younger shells the width is equal to or greater than the height, while in the adult the height always exceeds the width.

A syn-type of this species has been previously listed by Chapman[3] as *Productus subquadratus*. In his original description of that species, Morris[4] states that the surface of the valves is covered with coarse longitudinal plications and that the hinge-line is the greatest width of the shell. Later, Etheridge[5] describing *P. subquadratus* from Queensland, says that the umbo does not overhang the hinge-line. This species *W. imperfecta* is, therefore, distinct from *P. subquadratus*.

Specimen No.	1	2	3	4	5
Length	60	65	70	74	90
Height	31	38	43	43	49
Width	37	39	41	38	42
Length of the hinge-line	23	24	30	22	24
Depth	13	14	17	21	24
Length of the brachial valve ..	26	30	33	35	37

Dimensions of specimens of *Waagenoconcha imperfecta*.

The species is most closely related to *P. purdoni*[6], from which it may be distinguished by the texture of the spines. The spines are much closer and finer in this species than as described for *P. purdoni*.

In the diagnosis of the genus Waagenoconcha as given by King[7], he says, "the surface is marked by quincunxially arranged tubular spines in the youthful and adult stages, which become smaller and more closely packed together in old age." It must be noted that the present specimens do not agree with King's diagnosis, since the spines become more widely spaced towards the margin. Thus in a shell where the length of the pedicle valve is 74mm., at a distance of 25mm. from the umbo there are 14, at 44mm. 11, and at 68mm. 10 spines per cm. In spite of this discrepancy the species is referred without hesitation to the genus Waagenoconcha.

Locality: Luiluigui Station, Kimberley Division.

Holotype: University of Western Australia, Dept. of Geology, No. 3044.

Allotypes: University of Western Australia, Dept. of Geology, Nos. 2768,

3 Chapman, 1923, p. 36.

4 Morris, 1845, p. 284.

5 Etheridge and Jack, 1892, p. 253, Pl. 38, figs. 7-10.

6 Davidson, 1862, p. 31, Pl. 11, fig. 5; Reed, F. R. C., 1931 (a), p. 10, Pl. 111, fig. 2.

7 King, R. E., 1930, p. 80.

Genus PRODUCTUS, J. Sowerby.

1814. Sowerby, J., Mineral Conchology, Vol. 1., p. 153.

Productus subquadratus,[1] Morris.

1845. Morris in Strzelecki's Physical Description of New South Wales and Van Dieman's Land: p. 284.

For further references see—

1909. Etheridge and Dun, Records of the Geological Survey of New South Wales: Vol. 8, Pt. 4, p. 300, Pl. XLI., fig. 1-5.

A figure of this species is included in the plates. The specimen is a limonitic cast, and the muscle marks are clearly shown.

Locality: 2 miles North of Ballythanna Hill, Wooramel River.

Genus SEMINULA McCoy (not Hall and Clarke, 1894).

Genotype figured by McCoy, Carboniferous Limestone Fossils of Ireland: p. 150, fig. 31, 1844.

Seminula globulina Phillips.

Pl. 11, fig. 16-18.

1836. *Terebratula globulina* Phillips, Encyc. Met. Geol. in Mixed Sciences, Vol. IV., Pl. 111, fig. 3.

1850. *Camarophoria globulina* Phillips, King, Mon. Perm. Fossils: p. 120, Pl. VII., fig. 22-25.

1858. *Camarophoria globulina* Phillips, Davidson, Brit. Perm. Brachiopoda: p. 27, Pl. 11, fig. 28-31.

1883. *Camarophoria globulina* Phillips, Waagen, Salt Range Fossils, Productus-Limestone Group, Brachiopoda: Pal. Ind. Ser. XIII., Vol. 1, Pt. 4, p. 443, Pl. XXXIII., fig. 13-14.

The specimens agree in all essential features with those figured by Waagen, but differ slightly from those of King and Davidson, since the plications are more strongly marked on the English shells.

The smaller shells are smooth, and even on the larger the plications are marked only on the anterior margins. Several of the shells show marginal expansions of the valves.

Waagen distinguishes between *C. rhomboidea* Phillips, and *C. globulina* on the relative convexity of the ventral valves. On this criterion the specimens from the Irwin River must be placed in *C. globulina*. Sections of the shells show that the internal structure is in complete agreement with Camarophoria, as shown by Weller.[2]

---

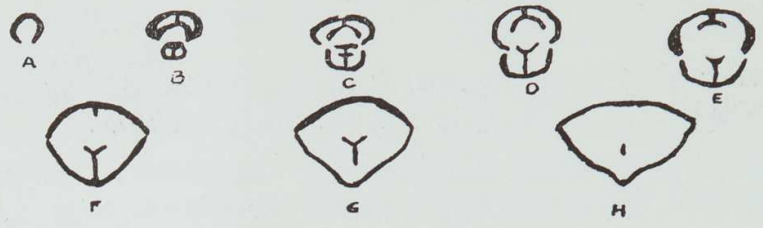
1 This species has been made the genotype for a new genus, Taeniothaerus Whitehouse. Since no description of the genus has been published it must be regarded as a nom. nudum.

The examination of a large series of specimens reveals that this species cannot be included in any of the recognised genera formerly grouped as Productus (s.l.).

2 Weller, 1914, p. 169, fig. 1.

In the pedicle valve is a strong median septum. The dental lamellae are continued anteriorly as a well-developed spondylium supported for the whole of its length by a median septum.

The hinge-plate of the brachial valve is continuous, and is supported by a median septum.



Text. Fig. 2. Sections through the rostral portion of *Seminula globulina* showing the internal structure.

This species has formerly been referred to the genus *Camarophoria*, King, but as Buckman[2] has pointed out, it really belongs to the genus *Seminula* McCoy, of which *Camaraphoria* King, may be regarded as a sub-genus, in which the shells are more transverse and plicate.

Localities: Holmwood, Irwin River District; Fossil Cliff, Irwin River District.

Specimens: No. 10370, 10371, Geol. Dept., University of Western Australia.

Genus COMPOSITA Brown.

1849. Brown, T., Illustr. Foss. Conch. Great Britain and Ireland, p. 131, Pl. LIV.*, fig. 6, 7.

1906. Buckman, S. S., Brachiopod Nomenclature: Ann. & Mag. Nat. Hist. Series 7, Vol. XVIII., p. 325.

Composita subtilita Hall.

Pl. III., fig. 4 & 5.

1852. *Terebratula subtilita* Hall, Stanbury's Expl. and Survey Great Salt Lake: p. 409, Pl. IV., fig. 1a-2c.

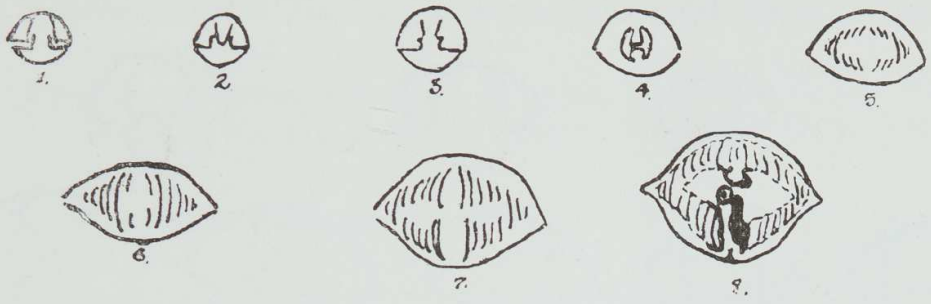
1923. *Seminula sp. nov.* (near *S. subtilita* Hall). Chapman, List of Fossils from the West Kimberley: G.S.W.A. Ann. Rept. 1923, p. 35.

Shell sub-oval to pentagonal in outline with the greatest width about half the length of the pedicle valve from the umbo. The shell is marked by concentric growth lines, there being no sign of secondary plications among these specimens. The pedicle valve is indented by a narrow sulcus which widens towards the margin. The valves are biconvex, the pedicle more convex than the brachial. The pedicle umbo overhangs the hinge-line and is perforated by an oval foramen.

Internally the shells exhibit the characteristic structures of Composita Brown.

2 Buckman, 1906, p. 325.

These shells have been previously listed as *Seminula* sp. nov. (near *S. subtilita* Hall) by Chapman, but I can see no reason for separating them from that species.



Text Fig. 3.—Series of sections through the umbo of *Composita subtilita* Hall, to show the internal structure.

The dimensions of the shells are shown by the following table:—

	Valve Length—			
	Pedicle.	Brachial.	Breadth.	Depth.
1.	21.5	16.0	12.4	8.5
2.	21.0	17.0	15.7	9.7
3.	28.0	18.0	16.3	12.3
4.	30.0	20.0	17.4	12.2
5.	30.5	21.0	17.6	12.5

This species has been formerly referred to Seminula McCoy, but Buckman has shown that this name should be replaced by Composita Brown since that has right of priority.

An excellent description of this species is given by Dunbar and Condra.[2]

Locality: 12 miles West of Oscar Range Homestead, about 120 miles E.S.E. of Derby, Kimberley.

Specimens Nos. 2507, 2510, University of W.A., Geol. Dept.

Genus CAMAROTOECHIA Hall and Clarke.

1894. Hall and Clarke, Palaeontology of New York, Vol. VIII., Pt. 2, p. 189.

Camarotoechia pleurodon (*Phillips*).

1836. *Rhynchonella pleurodon* Phillips, Geol. Yorks, Vol. II., Pl. 12, figs. 25-30, p. 222.

1858. *Rhynchonella pleurodon* Phillips, Davidson, Mon. Brit. Carb. Brach.: Vol. II., p. 101, Pl. XXIII., fig. 1-22.

1863. *Rhynchonella pleurodon*, Davidson, Mon. Brit. Dev. Brach.: p. 62, Pl. XIII., fig. 12-13.

1923. *Pugnax pleurodon*, Chapman, List of Fossils from the West Kimberley: G.S.W.A. Ann. Prog. Rept. 1923, p. 36.

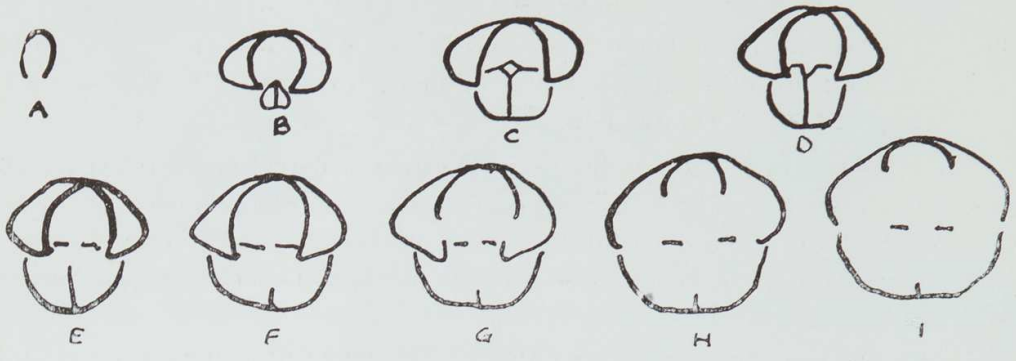
Sections through the umbo prove the specimens to belong to the genus Camarotoechia Hall and Clarke.

In the restral portion of the brachial valve the median septum is divided to form a V-shaped crural cavity, the walls of this cavity support a divided hinge-plate.

The dental lamellae of the pedicle valve are long, slender and diverging.

2 Dunbar and Condra, 1932, p. 363.

The shells agree with the figures and descriptions of *C. pleurodon* as given by Davidson. The umbo is pointed, slightly incurved and overhanging the hinge-line. The surface of both valves is covered with well-defined plications, of which there are from 15-18 on each valve.



Text Fig. 4. A series of sections through the rostral portion of Camarotoechia pleurodon, to show the internal characters.

The dimensions of the shells are shown by the table.

Specimen No.	Length.	Width.	Depth.	No. of plications on the fold.
A	12.5	18.0	9.0	5
B	11.4	16.3	6.9	5
C	12.5	16.6	4.7	4
D	9.0	13.7	8.4	4
E	11.1	13.7	6.3	4

The specimens show one difference from those of Davidson's, the plications of these shells are not grooved longitudinally.

Locality: Fossils Downs Station, Margaret River, Kimberley.

Specimens No. 2771, University of W.A., Department of Geology.

Camarotoechia pleurodon Phillips, var. tripla. var. nov.

Pl. II., fig. 1A-6.

1923 "Pugnax pleurodon," Chapman, List of Fossils from the West Kimberley: G.S. W.A. Ann. Prog. Rept., 1923, p. 35.

A large number of plicated Rhynchonellids from the Kimberley Division show a gradual variation from a small flat shell with no sinus to a much larger shell with a well-developed fold and sinus resembling *Camarotoechia pleurodon* in general outline.

On sectioning, both the larger and smaller shells show the internal characters of Camarotoechia as given by Weller.

In *C. pleurodon* the number of plications on the fold of the brachial valve is usually four, varying from three to nine according to the age of the shell. The number of plications on the fold in the Kimberley shells is always three, being independent of the size of the shell.

Again, while in *C. pleurodon* the plications are grooved longitudinally, not one of these specimens shows that condition.

These differences, constant in so many specimens (138) appear sufficiently well-marked to constitute a variation.

Locality: 12 miles S.W. of Oscar Range Homestead, about 120 miles E.S.E. of Derby, Kimberley.

Specimen Nos. 2512, 2513, 2514, University of Western Australia, Department of Geology.

Genus SPIRIFER Sowerby.

1816. Sowerby, J. Mineral Conchology of Great Britain, Vol. 2, p. 41. *Spirifer fasciger* Keyserling.

1843. Keyserling, Reise in das Petschoraland, p. 229, t.8, f.3, 3a,b. For reference and synonomy see—

1930. *Spirifer musakheylensis* Dav. Hosking, Fossils from the Wooramel District, Western Australia: Journ. Roy. Soc., W.A., Vol. XVII, p. 23, Pl. VII, fig. 1-2.

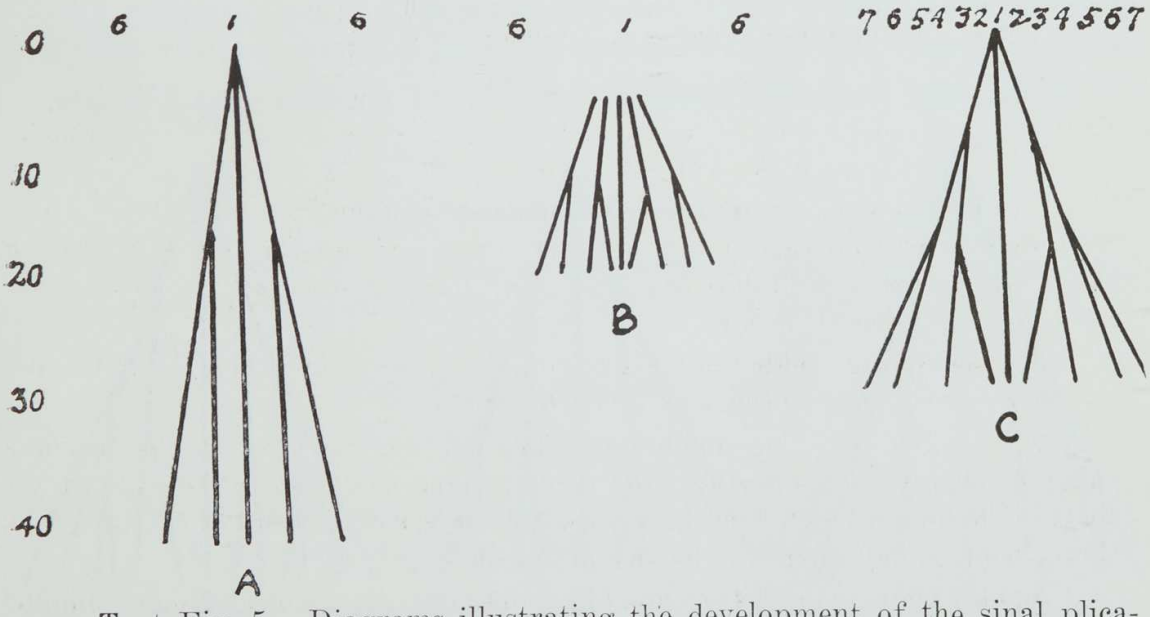
The specimens of this species from Western Australian beds are not preserved at all well. There is no record of a complete specimen, and the majority of single valves are crushed and broken. A few small valves are almost entire, and it is from these specimens that the notes have been compiled .

In all the specimens examined there is evidence of a median sinal plication. In tracing the development of the plications the younger specimens were the only ones found satisfactory. The concentric lamellar expansions of the shell surface tend to obscure the nature of the radial markings, and it was found easier to trace the plications on plasticine casts of the exterior of the shell. The hollows of the cast appeared more clearly defined than the ridges of the shell.

The smallest shell (A) of this species is an almost perfect valve. Both the bounding and laterial plications have each divided twice to give an external and an internal branch.

In the next stage (B) the first sinal plication has bifurcated and a second branch of the bounding plication has appeared.

The next increase is due to bifurcation of the second sinal plication. Beyond this stage the development cannot be traced without better specimens.



Text Fig. 5. Diagrams illustrating the development of the sinal plications in *Spirifer fasciger* Keyserling. (Not to scale.)

1 These specimens show a constant difference from the Mongolian species [1] in the possession of a median sinal plication.

[1] Grabau, A. W., 1931, pp. 163-178, Pl. XXIII.

The Australian species has been referred to *Spirifer fasciger*. Grabau, following Waagen, states that the differences between the two species is shown by the character of the primary plications. In *S. fasciger* they are angular, whereas in *S. musakheylensis* the outline is rounded. This criterion cannot be applied to the Western Australian shells since every gradation from sharply angular to almost flat and rounded plications may be seen.

Locality: Creek, ½ mile West of Callytharra Springs, Wooramel; Waltharrie Pools, Wooramel; Fossil Cliff, Irwin River District.

Specimens: No. 8490a, 6327, 10961, 10962, 10963, Geology Department, University of Western Australia. 1/4963, Geological Survey of Western Ausstralia.

Genus SPIRIFERELLA Tschernyschew.

1902. Tschernyschew, Mem. Comite. Geol., Russia, 1902, Vol. XVI., No. 2, pp. 121 and 522, Pl. XII., fig. 4, Pl. XI., fig. 7.

Spiriferella australasica Eth. Fil.

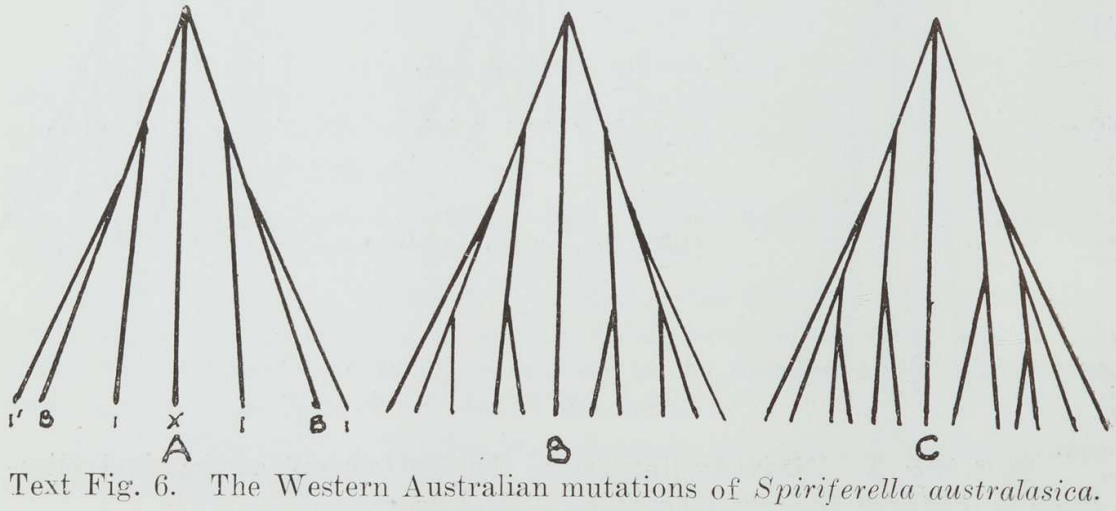
1915. *Spiriferella australasica* Eth. Fil., Western Australian Carboniferous Fossils, chiefly from the Mount Marmion, Lennard River, West Kimberley: G.S.W.A. Bull. 58, p. 30, Pl. V., fig. 6-13.

1931. *Spiriferella australasica* Eth. Fil, Hosking, Fossils from the Wooramel District: Journ. Roy. Soc., W.A., Vol. XVII., p. 29.

For further synonomy, see this paper.

The species may be divided into three mutations[2] according to the arrangement of the sinal plications. It has been said[3] that this species approximates closely to *S. saranae* Tschern, but examination of the sinal plications shows that it differs radically, since these is not a median plication in *S. saranae*, while in this species the sinus is always medially folded.

A diagram shows the difference between the mutations most clearly.



Text Fig. 6. The Western Australian mutations of *Spiriferella australasica*.

[2] The term "mutation" may be wrongly used here. The time sequence of the "mutations" is not known, but from the development of the forms it is thought that a, b, c, follow chronologically.

[3] Etheridge, 1914, p. 31.

In *mutation a* the bounding plications have each divided once, while the lateral plications are simple.

Mutation b is a second stage in the development of *mutation a*, in which the bounding plication has divided twice, and the first branch has bifurcated.

A much greater development is shown by *mutation c*, for here the lateral plications have each an internal branch, and the second branch of the bounding plication is an internal one.

Both mutations b. and c. have arisen from mutation a. by multiplication of the plicae. In Western Australian beds mutation a. is by far the most common form. The distribution of the mutations is shown by the table.

Locality.	Number of specimens— Mutation a.	Mutation b.	Mutation c.
Creek ½-mile W. of Callytharra Spring, Wooramel	14	4	2
S. bank of Wooramel, ¼-mile above Callytharra Spring	1	—	1
S. bank of Wooramel, below Callytharra Spring	1	—	—
Waltharrie Pools, Wooramel	4	—	—
Callytharra Spring, Wooramel	6	3	—
Irwin River	2	1	—
Bogadi Outcamp, Wooramel	3	—	—
Mt. Marmion, Kimberley	2	1	—

Although at this stage no conclusions may be drawn from this table, it is hoped that when accurate zoning of the beds is commenced the distribution of the mutations will be of some use.

Specimens:

Nos. 8497, 9669, 10941, 10942, 10939, 10940, 10965, Dept. of Geology, University of W.A.

Nos. 1/4658, 1/4666, 1/4681, 1/4691, 1/4964, Geological Survey of W.A.

Genus PHRICIDOTHYRIS George.

1932. George, N. T., The Carboniferous Reticulate Spiriferidae: Q.J.G.S. 1932, p. 524, Pl. XXXV., fig. 2a-2d.

Phricidothyris lineata (Martin).

Pl. III., fig. 6-8.

1931. *Reticularia lineata*, Hosking, Fossils from the Wooramel District, W.A.: Roy. Soc. W.A., Vol. XVII., p. 22.

1932. *Reticularia lineata*, George, N. T., The British Carboniferous Reticulae Spiriferidae: Q.J.G.S. 1932, p. 543.

Shells transverse, hinge-line about half the maximum width. Ornamentation of two series of spines, the larger biramous in character, arranged on concentric lamellae. Beak prominent and slightly incurved over a triangular delthyrium. The shell substance is impunctate and fibrous.

Internally the apical plates are well-developed and the shells possess a median septum.

When the shells are exfoliated they are seen to be covered with sharp plications. The spines are the elongations of these plications on the growth lamellae.

This series of shells is a particularly interesting one, since of the 60 specimens examined, 15 were rectimarginate, 40 had uniplicate, and 5 parasulcate margines

The classification of these shells thus becomes difficult. They have the external characters of Phricidothyris with the internal characters of Reticularia McCoy, s.s., that is, with a strong development of apical plates. But George[1] says, "The double-baralled spines of Phricidothyris . . . are so specialised that it is unlikely that they should have evolved homeomorphically in two separate stocks and they occur in such a self-contained group, obviously closely similar in other respects, that they almost constitute a truly differential character for the recognition of the genus."

The dimensions of the shells are shown by the following table:—

	Length.	Width.	Depth.
1.—Ventral Valves—			
(a) parasulcate	40	35	9
(b) uniplicate	39	34	13
(c) rectimarginate ..	32	27	7
2.—Dorsal Valves—			
(a)	30	32	7
(b) both uniplicate ..	36	37	8

Although the marginal characters of the specimens does not remain constant throughout the whole range of specimens, the internal structures and the ornamentation of the valves is the same; thus they have been placed in *P. lineata.*

Specimens Nos. 10927, 10928, 10929, 10930, University of W.A.

Localities: Fossil Cliff, Irwin River.

Waltharrie Pools, Wooramel River District.

Genus CLEIOTHYRIDINA Buckman.

1906. Buckman, S. S. Brachiopod Nomenclature: Ann. & Mag. Nat. Hist. Ser. 7, Vol. XVIII., p. 324.

Cleiothyridina roysii var. **penta** var. nov.

Pl. II., fig. 13-15.

1923. *Athyris sp.* aff. *A. lamellosa* l'Ev.

Athyris aff. *A. roysii* l'Ev. Chapman, List of Fossils from the West Kimberley; G.S.W.A. Ann. Prog. Rept., 1923, p. 36.

Although these specimens agree with *A. lamellosa* in general outline, they differ in almost all other particulars, notably in the absence of pectinated ridges.

1 George, N. T., 1933, p. 448.

They resemble *A. roysii* in the convexity of the valves, in the character of the ornamentation, and in having a sinus in the pedicle valves which causes the anterior margins of the valves to be waved. There may be a corresponding fold in the brachial valve but this is not usually well-developed. The hinge-plate takes the form of a flat triangular plate occupying the space between the dental sockets and spreading laterally between them. It is limited at both edges by ridges. The apex is perforated by a visceral foramen, which is continued in the hinge-plate as a narrow slit.

These shells from Luiluigui are distinct from *Cleiothyridina roysii* since the breadth of the shell is always greater than the length and it is more pentagonal in outline.

From *Cleiothyridina macleayana* Eth. Fil., the common Western Australian species, they are readily distinguished because in *C. roysii* the antero-lateral margins of the shell are not in the same plane as the hinge-line, the shell is more globose, and the general outline is pentagonal rather than rounded or oval.

Specimens Nos. 2777, 3039, 10666, University of W.A.

Locality: Luiluigui Station, Kimberley Division.

Genus ORIOCRASSATELLA Eth. Jun.

1906. Etheridge, R., jun. South Australian Parliamentary Papers, No. 55, p. 8.

Oriocrassatella stokesi Eth. jun.

Pl. II., fig. 19 & 20.

1906. *Oriocrassatella stokesi* Eth. fil, South Australian Parliamentary Papers No. 55, p. 9, Pl. VI., fig. 2-5.

1923. *cf. Protoschizodus*, Chapman, List of Fossils from the West Kimberley: G.S.W.A. Ann. Prog. Rept., 1923, p. 36.

The specimen No. A. from Chapman's list, is a right valve with the hinge-line entire, and agrees in all essentials with *O. stokesi* from Treachery Bay, Victoria River Estuary. As in that species, the chrondophore and anterior socket are large while the posterior socket is narrow, linear and obliquely inclined. This socket (the posterior) is more sharply limited than in the specimens figured by Etheridge and widens towards the hinge-margin. In this specimen the dental formula would be ROICIO.

Specimen No. 10665, University of W.A.

Locality: St. George's Range, Kimberley, nine miles E.N.E. by E. from Trig. Stn. G2.

DISTRIBUTION OF SPECIES.

The forms described in this paper may be grouped into three types.

The first group contains species common throughout the Western Tethyan beds. These are:—

Linoproductus cancriniformis Tschern.

Seminula globulina Phillips.

Spirifer musakheylensis Dav.

Cleiothyridina roysii l'Ev.

Linoproductus cancriniformis is not found in beds of greater age than Permian. It is very characteristic of the Artinskian Limestone of the Russian Permian, but is also found in the Lower Productus Limestone of the Salt Range of India, which is regarded as of Lower Permian age. The statement that *Linoproductus cancriniformis* is confined to the Permian is dependent on the conclusions of Grabau and Schuchert that the Permian should be continued downwards to include the Omphalotrochus and Cora zones. This species has been recorded from the Lower Zechstein of Germany and from the Vladivostock region, but is most common in the Russian formations.

Of widespread distribution, *Seminula globulina* ranges from Devonian to Permian in England, but is not known from formations older than Permian in Asia. It has been recorded from China (Yunnan), India (Salt Range), and the Schwagerina, Artinskian and higher Permian beds of Russia.

A common form in the beds of the Western Tethyan Permian, *Spirifer musakheylensis* is not found in formations of younger age. The species has been recorded from the Schwagerina Limestone, Russia, the Salt Range, and the Himalayan Permian beds, China, Indo-China, Mongolia, the Vladivostock region and Timor.

Cleiothyridina roysii is found in all the areas given for *Spirifer musakheylensis*, but continues downwards into the Carboniferous in the Donetz Basin.

In the second group there is only one form, *Productus subquadratus*, which is abundant in the Lower Bowen beds of Queensland. Reid (the Queensland Upper Palaeozoic Succession, Queensland Geol. Surv. Publication No. 278. p. 91) places this series as of Uralian age, and it will therefore be of Lower Permian time. Identifications of this species from the Star series (Carboniferous) have been questioned by Reid, who considers that *P. subquadratus* may prove diagnostic of the Lower Bowen beds. It is interesting to note that a form allied to *P. subquadratus* has been recorded from the Vladivostock region (Grabau, 1931, p. 528).

The third group includes the misfits, that is *Composita subtilita*, *Camarotoechia pleurodon*, and *Phricidothyris lineata*.

Composita subtilita ranges throughout the Pennsylvanian and into the early Permian of America.

It is possible that *Camarotoechia pleurodon* should have been included in the second group since it occurs in the Upper Devonian and Carboniferous of New South Wales. The difference in age between the beds containing it and those with *P. subquadratus* is sufficient to separate the two. In England this species ranges from the Devonian to the Permian, while in other parts of the world it is common in the Carboniferous.

In England, *Phricidothyris lineata* is not found in beds of older than Upper Avonian age; Girty states that in America the septate forms are not present below the Pennsylvanian. The upper limit is not determined.

Throughout his work, Grabau refers to *Squamularia asiatica* Chao, as a synonym of *Reticularia lineata*, so that it is not possible to compare the Western Australian and Asiatic distribution.

TABLE TO SHOW THE DISTRIBUTION OF THE SPECIES DESCRIBED.

——	——	Devonian.	Carboniferous.			Permian.		
			L.	M.	U.	L.	M.	U.
Linoproductus cancriniformis	Russia							
	Salt Range ...							
	Kashmir ...							
	Himalayas ...							
	E. Siberia ...							
Productus subquadratus	E. Siberia ...							
	E. Australia ...							
Seminula globulina ...	Gt. Britain ...							
	Russia							
	Salt Range ...							
	Yunnan, China ...							
Composita subtilita ...	Gt. Britain ...							
	U.S.A.							
Camarotoechia pleurodon	Gt. Britain ...							
	Russia							
	E. Australia ...							
Spirifer fasciger	Russia							
	Salt Range ...							
	Kashmir ...							
	Indo-China ...							
	Mongolia ...							
	E. Siberia ...							
	Timor							
Phricidothyris lineata ...	Gt. Britain ...							
Cleiothyridina roysii ...	Russia							
	Salt Range ...							
	Kashmir ...							
	Himalayas ...							
	Indo-China ...							
	Mongolia ...							
	E. Siberia ...							
	Timor							
	Gt. Britain ...							

BIBLIOGRAPHY.

1. Bretnall, Rex W.—
1926—Fossil Polyzoa: G.S.W.A. Bull. 55, p. 7.

2. Buckman, S. S.—
1906—Brachiopod Nomenclature: Ann. & Mag. Nat. Hist., Ser. 7, Vol. XVIII., 1906, p. 325.
1917—Brachiopoda of the Namyau Beds of Northen Shan States: Pal. Ind., Vol. III., Mem. No. 2.

3. Chapman, F.—
1907—Fossils from the Collie Coalfield, Western Australia: G.S.W.A. Bull. 27, p. 9.
1923—List of Fossils from the West Kimberley: G.S.W.A. Ann. Prog. Rept., 1923, p. 35.
1926—Age and Contents of the Negri Series, Kimberley: G.S.W.A. Bull. 88, p. 34.
1930—Wooramel River Limestone: Commonwealth Palaeontologist's Report, M.S.
1931—Fossils from the Wooramel River: Commonwealth Palaeontologist's Report, M.S.

4. Condra, G. E., and Dunbar, C. O.—
1932—Brachiopoda of the Pennsylvanian System of Nebraska: Nebraska Geol. Surv. Bull. 5, Second Series.

5. David, Sir Edgeworth, and Dun, W. S.—
1923—Gastrioceras at Irwin River Coalfield, Western Australia: Journ. & Proc. Roy. Soc. N.S.W., LVI., 1923, p. 249.

6. Davidson, T.—
1858-1880—British Fossil Brachiopoda: Monographs of the Palaeontological Society.
1862—Carboniferous Brachiopods collected in India: Q.J.G.S., Vol. XVIII., p. 25-35.
1866—Carboniferous, Jurassic and Cretaceous Brachiopoda collected in the Mustakh Hills, Thibet: Q.J.G.S., Vol. XXII., p. 39-45.

7. Diener, C.—
1897—(a) The Permo-Carboniferous Fauna of Chitichun: No. 1, Pal. Ind., Ser. XV., Vol. I., Pt. III.
(b) The Permian Fossils of the Productus Shales of Kumaon and Gurhwal: Pal. Ind., Ser. XV., Vol. I., Pt. IV.
1908—The Permian Fossils of the Central Himalayas: Pal. Ind., Ser. XV., Vol. I., Pt. V.
1909—Anthracolithic Fossils of Kashmir and Spiti: Pal. Ind., Ser. XV., Vol. I., Pt. II.
1911—Anthracolithic Fossils of the Shan States: Pal. Ind., N.S., Vol. III., Mem. IV.
1915—The Anthracolithic Fossils of Kashmir, Kanaur and Spiti: Pal. Ind., N.S., Vol. V., Mem. II.

8. Dun, W. S.—
1909—See Etheridge, R.
1923—See David, Sir Edgeworth.

9. Dunbar, C. O.—
1932—See Condra, G. E.

10. Etheridge, R., jun.,—
1878—Catalogue of Australian Fossils.
1889—(a) Fossils of Permo-Carboniferous Age from North-West Australia: Proc. Linn. Soc. N.S.W., Vol. IV., p. 199.
(b) On Permo-Carboniferous Fossils from the Irwin River Coalfield, W.A.: Appendix 5c, Ann. Rept. Dept. Mines, N.S.W., 1889, p. 239.
1892—(with Jack, W. L.)—Geology and Palaeontology of Queensland.
1903—Palaeontological Contributions to the Geology of Western Australia: Pt. I., G.S.W.A. Bull. 10.
1906—Palaeontology of South Australia: Supplement to South Australian Parliamentary Paper No. 55.
1907—Fossils from Mingenew, Irwin River Coalfield, Carboniferous Fossils from the Irwin River: G.S.W.A. Bull. 27.
1909—(with Dun, W. S.)—Permo-Carboniferous Producti of Eastern Australia: Rec. G.S.N.S.W., Vol. 8, Pt. 4, p. 293.
1914—Western Australian Carboniferous Fossils from Mount Marmion, Lennard River, West Kimberley: G.S.W.A. Bull. 58.
1917—Carboniferous and other Fossils in North-Western Australia: Trans. Roy. Geog. Soc. Australasia, S.A. Branch, Vol. XVIII.

11. Foord, A. H.—
1890—Palaeontology of Western Australia: Geol. Mag. N.S., Dec. III., Vol. VII., p. 152.

12. George, N. T.—
1932—The British Carboniferous Reticulate Spiriferidae: Q.J.G.S., 1932, p. 540.
1933—Principles in the Classification of the Spiriferidae: Ann. & Mag. Nat. Hist., 10th Series, Vol. XI., No. 64, p. 423.

13. Gibb-Maitland, A.—
1907—Recent Advances in the Knowledge of the Geology of Western Australia: Australian Association for the Advancement of Science, 1907, p. 131.

14. Glauert, L.—
1910—(a) A List of Western Australian Fossils systematically arranged: G.S.W.A. Bull. 36, p. 71.
(b) Fossils from the Barker Gorge, Napier Range, Kimberley: G.S.W.A. Bull. 36, p. 111.
1912—Permo-Carboniferous Fossils from Byro Station, Murchison District: Rec. W.A. Museum & Art Gallery, Vol. I., Pt. II, p. 75.

15. Grabau, A. W.—
1931—The Permian of Mongolia: Natural History of Central Asia, Vol. IV.

16. Hosking, L. F. V.—
1931—Fossils from the Wooramel District, Western Australia: Journ. Roy. Soc. W.A., Vol. XVII., p. 7.
1932—Western Australian Orthotetinae: Journ. Roy. Soc. W.A., Vol. XVIII., p. 43.
1933—(a) Aulosteges from Western Australia: Journ. Roy. Soc. W.A., Vol. XIX., p. 33.
(b) Fossils from the Wooramel District: Journ. Roy. Soc. W.A., Vol. XIX., p. 43.
(c) Collection of Devonian Fossils from the Kimberley Division: Journ. Roy. Soc. W.A., Vol. XIX., p. 67.
(d) Correlation of Carboniferous and Permian Rocks of Western Australia: Report of the Australian and New Zealand Association for the Advancement of Science, Vol. XXI., p. 456.

17. Howchin, W.—
1895—Carboniferous Foraminifera of Western Australia: Trans. Roy. Soc. S.A., Vol. XIX., Pt. 2.

18. Hudleston, W. H.—
1883—Fossil Specimens from Western Australia, North of the Gascoyne River: Q.J.G.S., Vol. 39, p. 582.

19. Jack, W. L.—
1892—See Etheridge, R.

20. King, R. E.—
1930—The Geology of the Glass Mountains, Texas: University of Texas Bulletin, No. 3042.

21. Morris, J.—
1845—In Strzelecki's Physical Description of N.S.W. and Van Dieman's Land.

22. Muir-Wood, H. W.—
1930—Classification of the British Carboniferous Productinae: Ann. & Mag. Nat. Hist., 10th Ser., Vol. V., p. 100.

23. Newton, R. B.—
1892—On the Occurrence of Chonetes pratti (Davidson) in the Carboniferous Rocks of Western Australia: Geol. Mag., Dec. III., Vol. IX.

24. Paeckelmann, W.—
1931—Die Fauna des deutschen Untercarbons, 2 Teil, Die Brachiopoden, 2 Teil.

25. Reed, F. R. Cowper—
1931—(a) Fossils from the Productus Limestone of the Salt Range: Pal. Ind., N.S., Vol. XVII.
(b) Upper Carboniferous Fossils from Afghanistan: Pal. Ind., N.S., Vol. XIX.
1932—New Fossils from the Agglomerate Slate of Kashmir: Pal. Ind., N.S., Vol. XX., Mem. I.

26. Thomson, J. Allan—
1925—The Interrelations of the sub-families of the Telotremata: Ann. & Mag. Nat. Hist., Ser. 9, Vol. XVI., p. 425.
1927—Brachiopod Morphology and Genera: N.Z. Board of Science & Art, Manual No. 7.

27. Waagen, W.—
1883—Salt Range Fossils, Productus-Limestone Brachiopoda: Pal. Ind., Ser. XIII., Vol. I., Pt. 4.

28. Wade, A.—
1924—Petroleum Prospects: Commonwealth Parliamentary Paper No. 142.

29. Weller, S.—
1914—Mississippian Brachiopoda: State of Illinois Geol. Surv., Mon. I.

30. Whitehouse, F. W.—
1926—Upper Palaeozoic Marine Horizons in Australia: Australian Association for the Advancement of Science, 1926, p. 281.

31. Woodward, Henry—
1886—On a remarkable Ichthyodorulite from the Carboniferous Series, Gascoyne, W.A.: Geol. Mag., Dec. III., Vol. III., p.

32. Woodward, H. Page—
1890—List of Fossils found in the Colony: G.S.W.A. Ann. Gen. Rept., 1890, p. 14.

EXPLANATION OF PLATES.

Plate II.

Figures 1-5.—*Camarotoechia pleurodon* var. **tripla** var. nov. Morphotypes. Dept. of Geology No. 2515. 1A-5A, Dorsal view. 1B-5B, Anterior view to show development of the sinus.

Figure 6.—*Camarotoechia pleurodon* var. **tripla** var. nov. Morphotype. Side view.

Figures 7-12.—*Linoproductus cancriniformis* Tschern. 7, Side view of Brachial valve. Dept. of Geology, No. 10822. 8, Same specimen from above. 9, Specimen showing ornamentation. Dept. of Geology, No. 10822. 10, Specimen of pedicle valve. 11, Pedicle valve. Paratype of *Productus bellus* Eth. Jun. 12, Pedicle valve. Australian Museum specimen.

Figures 13-15.—*Cleiothyridina roysii* L'Ev. var. **penta** var. nov. Dept. of Geology, No. 3039.

Figures 16-18.—*Seminula globulina* Phil. Dept. of Geology, No. 10370.

Figures 19-20.—*Oriocrassatella stokesi* Eth. Jun. Dept. of Geology, No. 10665.

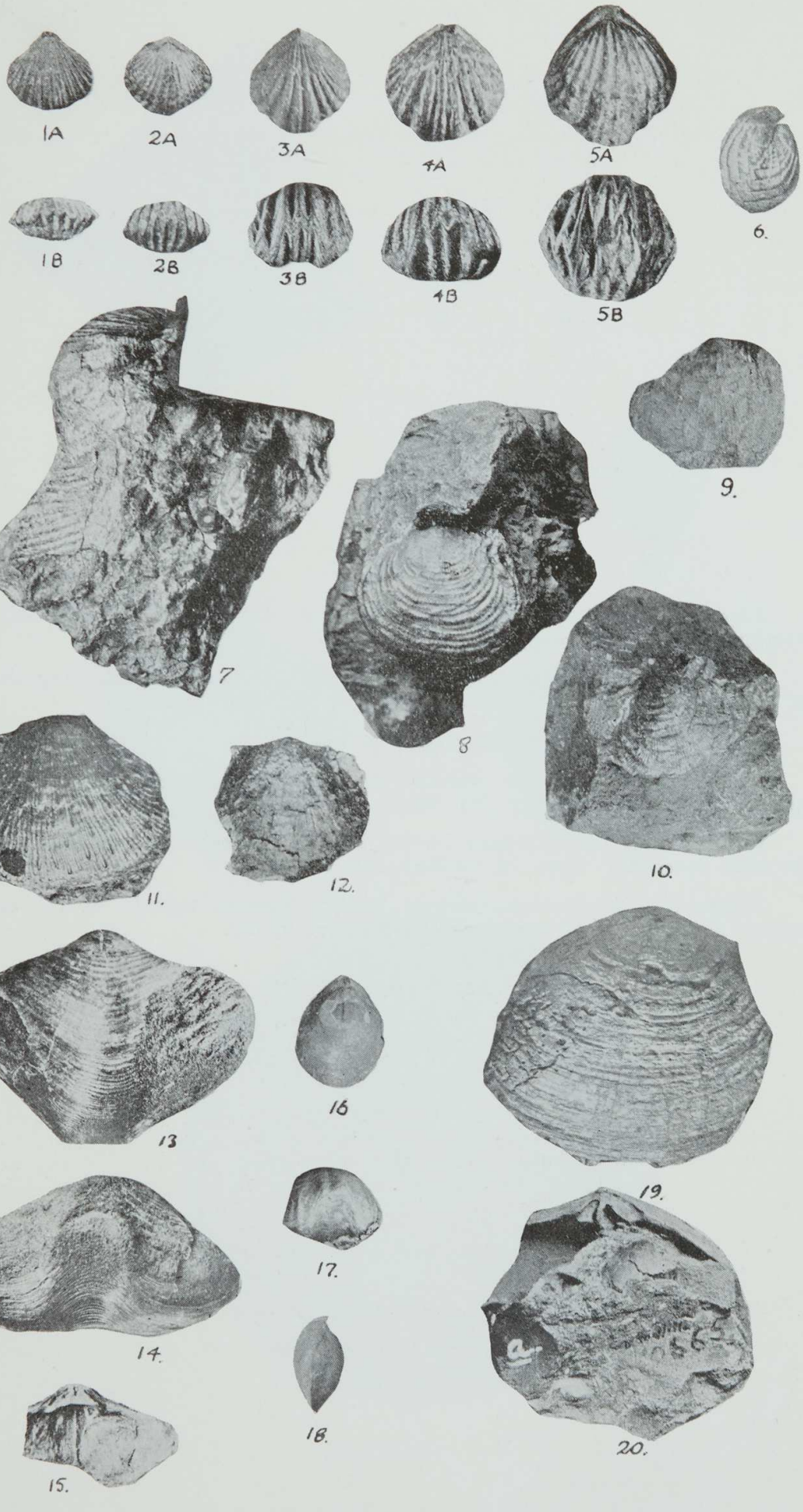


PLATE II.

Plate III.

Figure 1.—**Spanodonta hoskingiae** sp. nov.—Interior of the brachial valve. Syntype. Dept. of Geology, No. 3052.

Figure 2.—**Spanodonta hoskingiae** sp. nov.—Dorsal view showing the area of both valves. Syntype. Dept. of Geology, No. 2530.

Figure 3.—**Spanodonta hoskingiae** sp. nov.—Side view of syntype No. 2530.

Figures 4-5.—*Composita subtilita* Hall. Dorsal and side views of the same specimen. Dept. of Geology, No. 2507.

Figures 6-7.—*Phricidothyris lineata* Martin. Interior and exterior views of the same specimen. Dept. of Geology, No. 10927.

Figure 8.—*Phricidothyris lineata* Martin. Microphotograph of the external surface showing the biramous character of the spines.

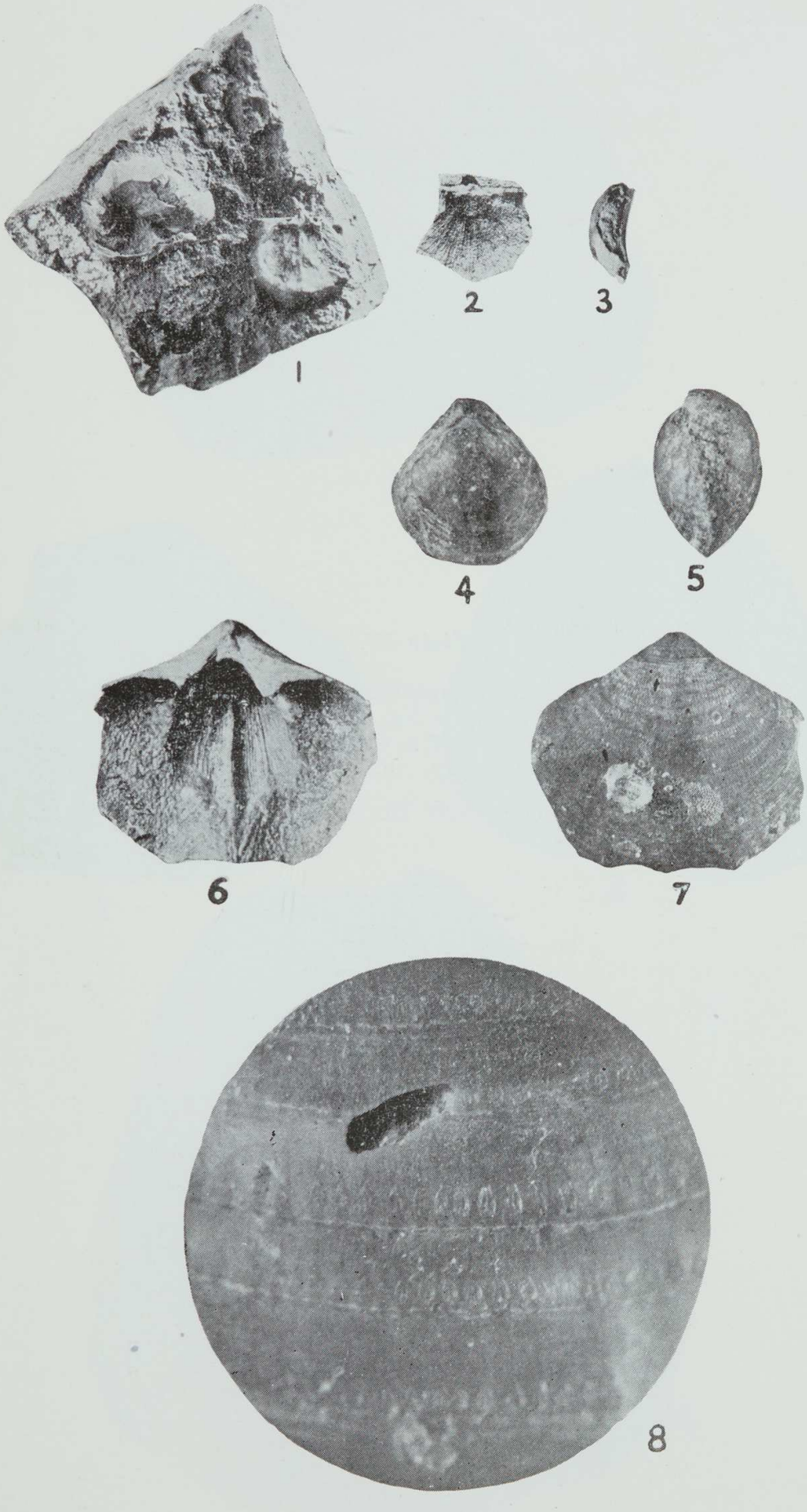


PLATE III.

Plate IV.

Figure 1-3.—**Waagenochoncha imperfecta** sp. nov.—1, Syntype No. 2777.—Cast of the brachial valve. 2, Syntype No. 3044—Pedicle valve. 3, Syntype No. 2768—Dorsal view of brachial valve of a weathered specimen. All specimens in the collection of the Dept. of Geology.

Figure 4.—*Productus subquadratus* Morris. Dorsal view of a limonite cast. Dept. of Geolgoy, No. 10931.

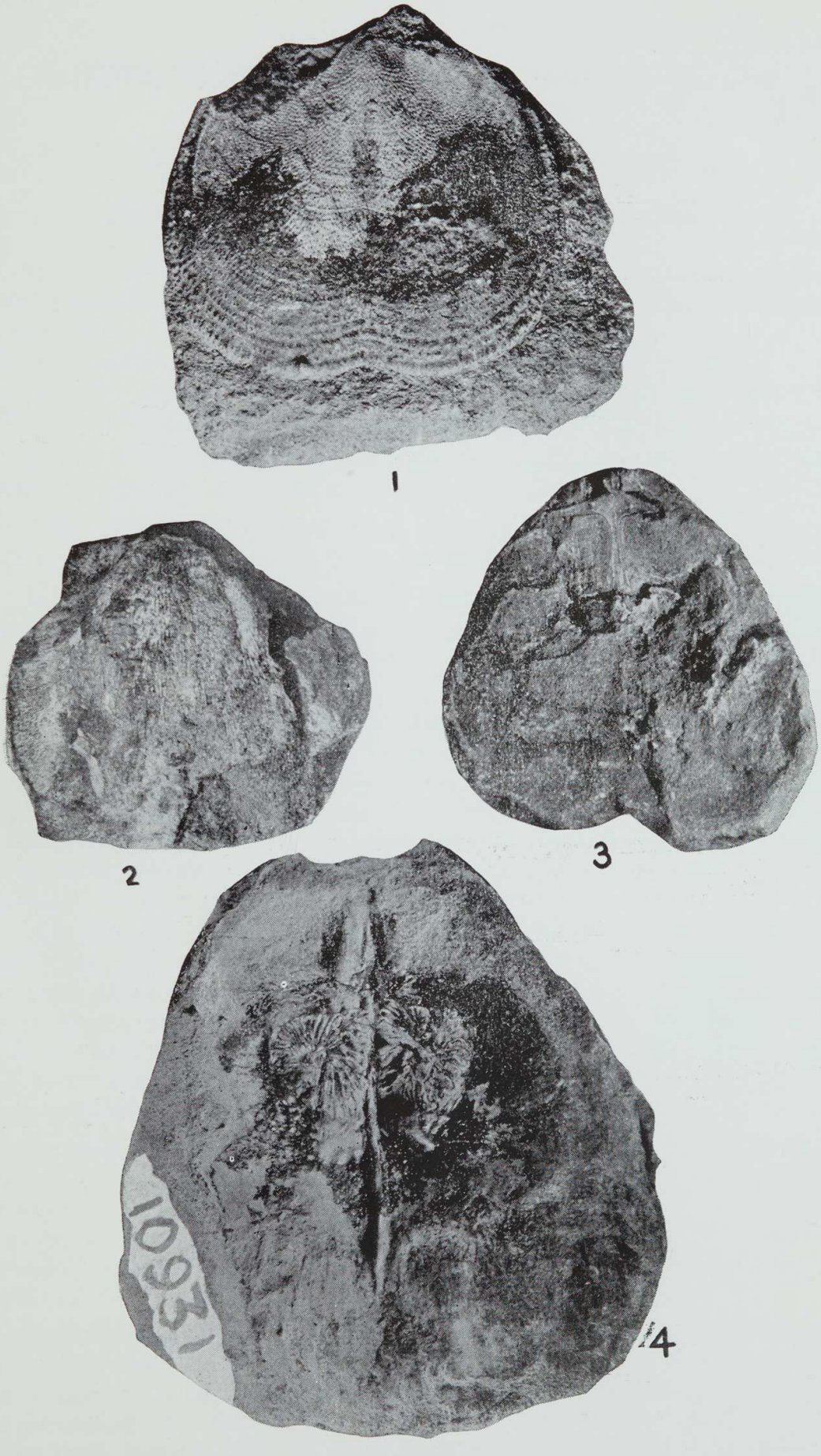


PLATE IV.

By Authority: FRED. WM. SIMPSON, Government Printer, Perth.